

PATENT SPECIFICATION

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(54) PRODUCTION OF COMPOSITE BODIES

(71) We, SWISS ALUMINIUM LTD., a corporation company, organized under the laws of Switzerland, of Chippis (Canton of Valais), Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Laminates consisting of aluminium sheets with plane surfaces and an intermediate layer of polyethylene are known. Such laminates are advantageous in weight and cost in comparison with bodies consisting entirely of metal. They are fully able to compete with the latter as regards strength, however, only if they are so designed that the mechanical stresses that arise are taken by the metal outer skin. It is often therefore desirable to make the laminates in some form other than that of flat plates or sheets.

Flat laminates have been shaped, for example corrugated, as such, but this method can be used only to a limited extent, since the deformability of the composite structure is limited. In the production of corrugated laminates, for example, the smallest possible radius of corrugation is about two to three times the total thickness of the laminate. Moreover, more complex shapes cannot be produced at all.

According to this invention a non-planar laminate is produced from two metal sheets and a synthetic resin capable of attaining a thermoplastic state by forming one or both of the metal sheets into a non-planar shape, interposing a layer of the resin between the two metal sheets, and subjecting the assembly to heat and pressure to cause the resin to enter the thermoplastic state and both to fill the space between the two metal sheets completely and to become bonded

to them without further deformation of the metal sheets.

By the use of non-planar sheets, which may be corrugated, bent, embossed or shaped by other methods into desired shapes, laminates of diverse shape, either symmetrical or asymmetrical with respect to the central plane of the layer of resin, can be produced. Moreover, the layer of resin does not have to be of the same thickness throughout, as is the case with flat laminates and shaped bodies produced from them.

The sheets may consist of various metals, aluminium and its alloys being particularly suitable. These are preferably used in thicknesses of from 0.2 to 1 mm, since in these thicknesses aluminium can be shaped satisfactorily and yet has sufficient stability of shape and inherent rigidity to resist the pressure applied to the assembly of sheets and plastic without deformation. The surfaces of the sheets may be treated and finished in any appropriate way before or after the pressing in order to give the laminate a desired appearance.

To ensure the necessary adhesion between the resin and the metal various methods may be used. Thus, the metal surface may be roughened or given a suitable adhesive coating by chemical treatment or be coated with an adhesive; or the resin layer may be provided with an adhesive coating, or an adhesive foil may be inserted between the resin and the metal. Combinations of these methods may be used.

The thickness of the resin layer is preferably from 1 to 8 mm. The layer may be reinforced by wire, glass fabric, or other reinforcement.

The resin is preferably a polyolefin, for example polyethylene or polypropylene, but

4. A method of producing non-planar laminates from two metal sheets and a synthetic resin capable of attaining a thermoplastic state in which two metal strips are formed into the non-planar shape in rolling mills, a strip of the resin is fed between them, the resultant assembly is passed while hot through a press and there subjected to such pressure as to cause the resin to enter the thermoplastic state and both to fill the space between the two metal strips completely and to become bonded to them, and the pressed assembly is cut into lengths without further deformation of the metal strips.
5. A method according to claim 4 in which adhesive foils are fed between the resin and the metal strips.
6. A method according to any preceding claim in which the metal sheets are of aluminium with a thickness of from 0.2 to 1 mm.
7. A method according to any preceding claim in which the resin is a polyolefin.
8. A method according to any preceding claim in which the resin on attaining the thermoplastic state can be hardenable by heat, is pressed in the thermoplastic state, and is subsequently hardened.
9. A method according to any preceding claim in which both metal sheets have parallel undulations, corrugations or ribs, those in the one sheet being also parallel to those in the other.
10. A method according to any of claim 1 to 8 in which both metal sheets have parallel undulations, corrugations or ribs, those in the one sheet being at right angles to those in the other.
11. Laminates produced by a method according to any preceding claim.

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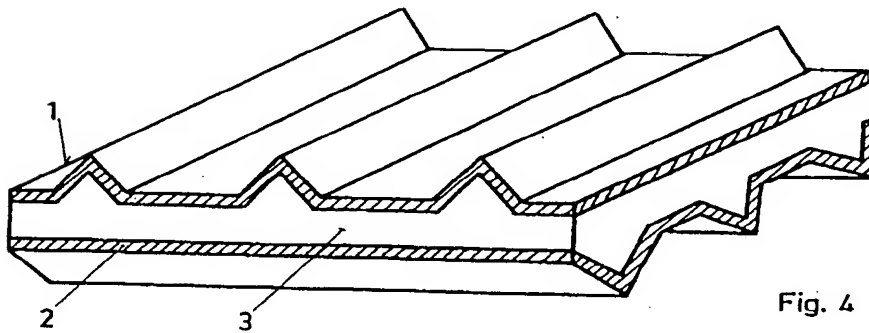
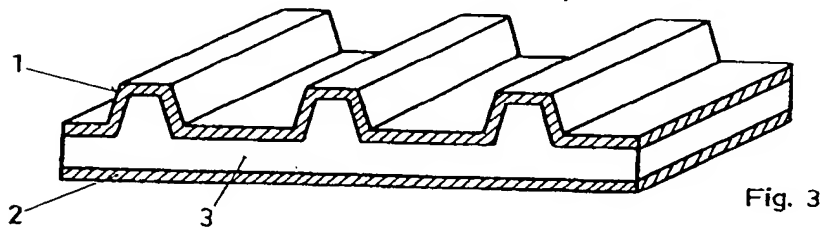
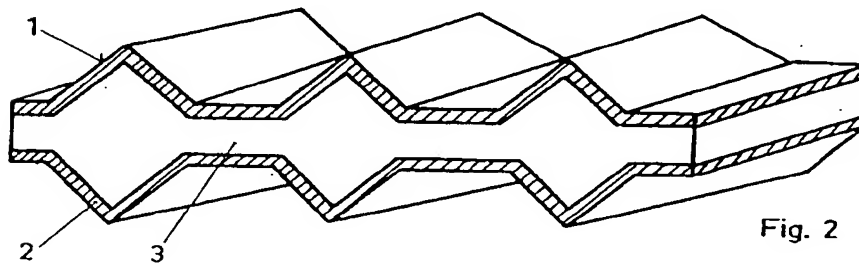
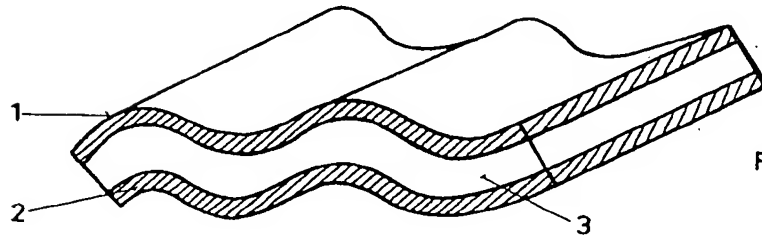
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COMPLETE SPECIFICATION

3 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 1



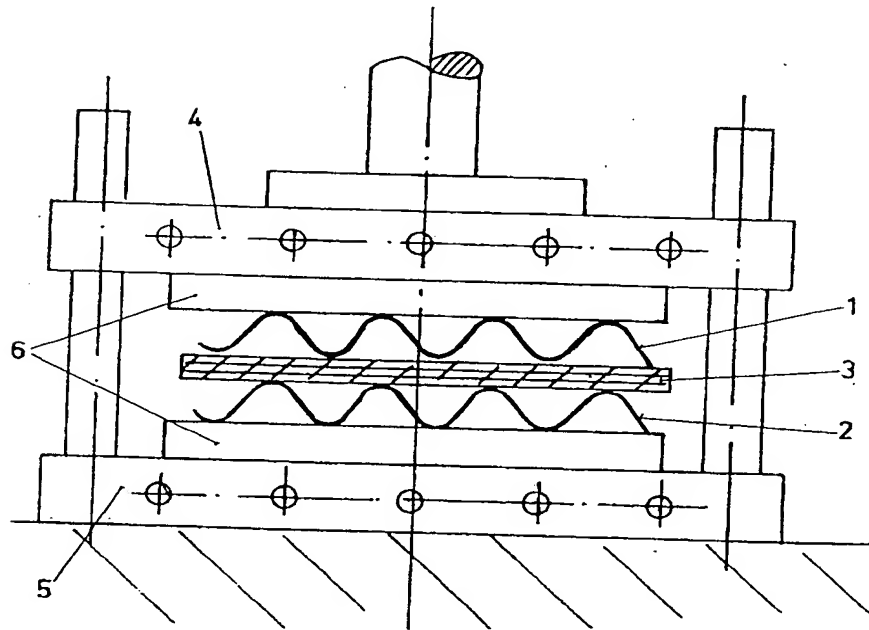


Fig. 5

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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 3

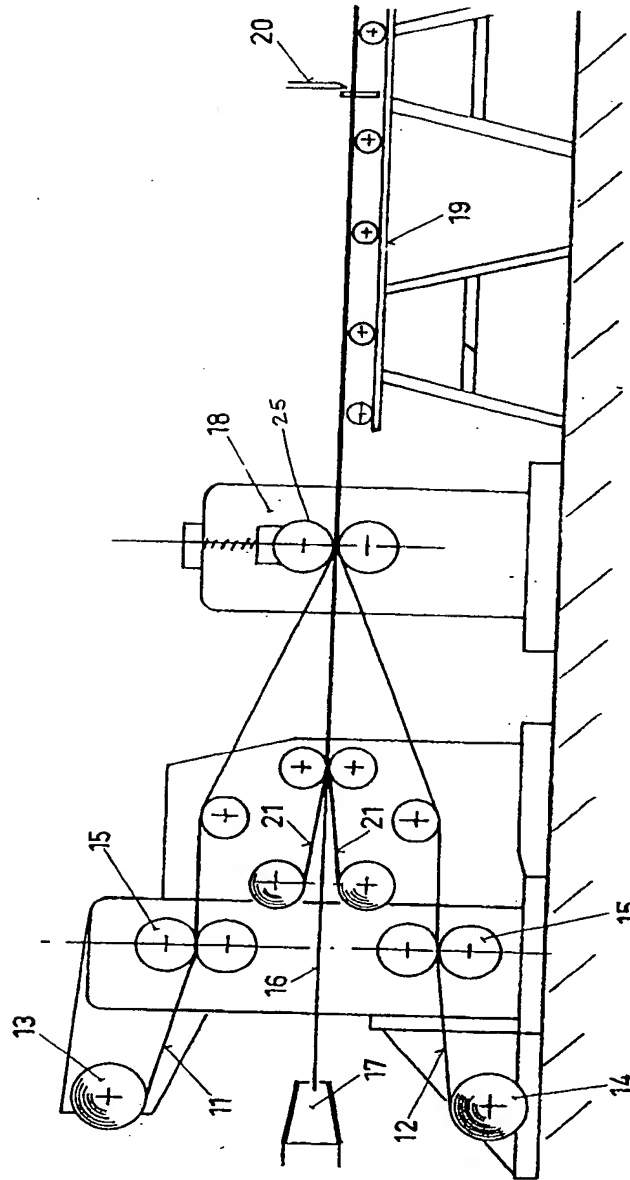


Fig. 6

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12 March 2001

Dear Neil

British Patent Application No. 0021662.2
SANDWICH PLATE RAMPS
Your Ref: "Bow Fingers"
Our Ref: N.80420 JGL/amw

I enclose a copy of an Official Letter from the Patent Office regarding completion of the search for prior art relating to this application. Also enclosed are copies of the Search Report and each of the documents cited.

You will see that of the three cited documents, the first is the British Clean Sheet application and the third is the US equivalent. The second document is new and describes a laminate structure with thin outer aluminium sheets and a resin core. I do not think that this document is particularly relevant to SPS since the aluminium layers are relatively thin, 0.2 to 1mm, and the Examiner apparently shares this view since he has put it in the category of technological background only. However, it is probable that this application should be disclosed to the US Patent Office and you may therefore wish to forward a copy to Darby & Darby so that they can file an appropriate information disclosure in any relevant US applications. If Darby & Darby agree that this document is sufficiently relevant to require its disclosure to the US Patent Office then an information disclosure statement should be filed within three months of our having become aware of this document, i.e. by 2 June 2001.

You will see that the Examiner has cited the original British Clean Sheet application as being particularly relevant to claim 1 of the present application. The passages that the Examiner specifically indicates are general statements that SPS can be used in ship-building applications. The passages do not specifically refer to SPS being useable in moveable ramps but the Examiner

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presumably considers that the general statement that SPS is useable in ship-building applications would lead the skilled man to consider using it to form moveable ramps. If this application proceeds to examination, we will have to formulate arguments as to why this is not the case or else narrow the claims.

This application was filed on 4 September 2000 so that if we wish to file any further applications claiming priority from it these will need to be filed by 4 September 2001. I will remind you again in this regard nearer the due date but if you would like further advice on the costs of foreign filing, please let me know in which countries you are interested. I assume that since this application is directed to a relatively specific application of SPS you will be considering filing in a relatively restricted list of countries as compared to the Core Technology applications.

Yours sincerely



JOHN LEEMING

- EPO
- Japan
- S. Korea
- US
- China